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DEVICE FOR CONFIGURING SURGICAL SYSTEMS
[EINRICHTUNG ZUR KONFIGURATION CHIRURGISHCER SYSTEME]

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Description /1*

Surgical systems here means, for example, medical technology devices, to which identical and/or different surgical instruments are connected simultaneously or sequentially via electric lines and, in a given case, also hoses. A surgical system of this kind consists, for example, of a high-frequency surgery device and HF surgical instruments, that may be connected simultaneously or sequentially to this high-frequency device via electric lines. There are different high-frequency devices. A high-frequency surgical device consists, for example, of at least one high-frequency generator for generating high-frequency electric voltages, respectively currents, for monopolar, bipolar, or quasi-bipolar cutting and/or coagulation of biological tissue as well as devices for adjusting, monitoring, controlling, limiting, and/or modulating HF-voltages, HF-currents, electric arcs between active electrodes, and biological tissue, and/or the power. High-frequency surgical devices can also be equipped with different operating modes for cutting and/or coagulating, such as, for example soft coagulation, forced coagulation, spray coagulation, continuous cutting or fractionated cutting, and automatic cutting control. High-frequency surgical devices can also be equipped with devices for manual and/or automatic monitoring of different safety criteria, etc. HF surgical instruments are, for example, monofunctional, bifunctional, or multifunctional instruments for monopolar, bipolar, or quasi-bipolar cutting and/or coagulating

*Numbers in the margin indicate pagination in the foreign text.

biological tissue.

The number of different instruments for high-frequency surgery has continued to increase in almost all surgical fields since the development of minimal invasive surgery (MIC).

In this way, the personnel requirements with respect to the correct adjustment of the high-frequency surgery device connected to these instruments also are increasing. As a rule, an instrument change during an operation requires a change in the adjustments of the high-frequency surgery device, which diverts the attention of the operating team from the operation.

However, surgical systems here also means surgical instruments to which identical or different devices can be connected simultaneously or sequentially via electric lines and, in a given case, also via hoses. This means surgical systems in the case of which, for example, multifunctional surgical instruments are connected or may be connected to different devices, which instruments, in addition to cutting and/or coagulating, can also be used, for example, for suction and/or washing and which also can be equipped with automatic actors, in order, for example, to bring a cutting electrode automatically into the operating position or resting position (see G. Farin, Pneumatically Controlled Bipolar Cutting Instrument, in the journal Endoscopic Surgery and Allied technologies, Vol. 1, No. 2, April 1993, page 93 to 101, Verlag Thieme, Stuttgart, New York). Relevant devices for this may be, for example, the above-mentioned high-frequency surgery device or devices for sucking gases and/or liquids from the operating field, devices for

washing the operating field, pneumatic actors, etc.

Different problems are known in the case of using surgical systems. For example, if a certain surgical instrument is connected to a high-frequency surgical device, the adjustments relevant to this instrument must be made on the high-frequency surgical device. In the case of a high-frequency surgical device, as a rule this concerns the adjustment of one or more operating means, such as, for example monopolar, bipolar, or quasi-bipolar cutting as well as the cutting qualities and voltage, current, or power limitations relevant for this. If a surgical instrument also is connected to other devices, such as, for example, a suction device, a washing device, a pneumatic control device, etc., as a rule these devices also are adjusted instrument-specifically. If a surgical instrument is replaced by another surgical instrument during an operation, as a rule the adjustments on the high-frequency surgical device and/or the adjustments of other devices connected to the respective instrument also must be changed corresponding to the respective instrument. If the adjustment is not changed corresponding to the respective instrument, the desired surgical effect can fail to appear or an undesired effect and/or damage to the patient and/or instrument may appear. For example if a multifunctional instrument which is simultaneously connected different devices, is replaced by another multifunctional instrument during an operation, as a rule several of these devices must be readjusted, respectively configured corresponding to the multifunctional instrument connected in each

case.

The object of the invention is to configure a surgical system so that incorrect adjustments, respectively inappropriate device configurations, respectively system configurations, which can lead to undesired effects and/or injuries to the patient and/or damage to the respective surgical instrument and/or time-consuming device, respectively system adjustments are avoided. This object is achieved by the object of Patent Claims 1 or 2. Configurations of the invention are the object of the Subclaims.

The achievement of this object in accordance with the invention consists in the fact that each of the surgical instruments is equipped with an electric or electronic coding device, and that for the device or devices, to which one or more of these surgical instruments can be connected sequentially or simultaneously, at least one electric or electronic decoding device is provided, that can be connected with the coding device, respectively the coding devices, of the surgical /2 instruments in each case connected to the device, respectively to the devices, and which converts, respectively convert the coding of the coding device of these surgical instruments in each case connected with them, the control and/or monitoring devices of the device, respectively devices, of the surgical system are supplied, in order to adjust the device, respectively the devices, of the surgical system automatically to a predetermined operating mode corresponding to the respective coding, respectively a device, respectively system configuration corresponding to the respective coding. Device,

respectively system, configuration here means all adjustments on the device, respectively on the devices of the system that are necessary for the authorized and/or safe operation of the respective surgical system.

The coding device, with which the surgical instruments are equipped in accordance with the invention, consists, for example, of an electronic component, which has a specific electric impedance. Electric resistors, condensers, and/or inductances are appropriate for this. The corresponding impedances are correspondingly real, capacitive, inductive, or complex. The coding of this coding device takes place by specific gradation of the type and/or amount of the impedance.

If the coding device consists, for example, of a real electric resistor, the coding can take place in a specific gradation of the amount of the capacity of the condenser, for example in 10-nF steps.

For example, if the coding device consists of a condenser and an inductance, which are connected in series or parallel, the coding can take place in a specific gradation of the resonance frequency of the series or parallel circuit, for example in 1-kHz steps.

Thus the different surgical instruments in each case can be associated with the different surgical instruments.

The decoding device, which can be electrically connected with the coding device, for example via the connecting cable between surgical instrument and device, the respective coding, that is, the respective impedance, respectively resonance frequency, converts into specific

electric signals. These electric signals can be supplied either directly or via a microprocessor to control and/or monitoring devices of the surgical system, in order to configure the surgical system automatically to an operating mode corresponding to the respective coding.

The decoding can be a component of a device connected with the surgical instrument or a separate device, which is connected with the devices, to which the respective surgical instrument can be connected.

The device or system configuration associated with the respective coding can be associated with the decoding device or the devices concerned as a software program.

The decoding device can be configured, for example, so that it constantly interrogates the connections of the devices, to which the respective surgical instruments can be connected, and to which the coding device of the respective surgical instruments also are connected, for the coding, the surgical system not being capable of being activated as long as the decoding device does not recognize any authorized specific coding and the surgical system configures corresponding to the pre-determined device or system configuration as long as the corresponding coding is recognized.

The decoding device can also be configured, for example, so that it first interrogates the coding of the corresponding surgical instrument after each activation of a surgical instrument connected to the surgical system, then the system is automatically coded corresponding to the recognized coding, and only then triggers the

activation. If several surgical instruments can be connected to surgical system simultaneously, it may be advantageous if the automatic interrogation of the coding of an instrument and the automatic configuration of the surgical system is triggered by an activation signal clearly associated with this surgical instrument.

One configuration of the device in accordance with the invention consists in the fact that in each case the surgical instrument recognized by the decoding device is indicated, respectively represented by an instrument number, an instrument name and/or graphically on an appropriate electronic display.

A further configuration of the device in accordance with the invention consists in the fact that the device or system configuration associated with a specific coding is programmable. This programming can be carried out, for example, by correspondingly manually adjusting the device or system concerned and this adjustment can be associated with a specific coding, and stored in an electronic memory, from which it can be called up automatically by the corresponding coding.

The invention is described in greater detail below by means of specific embodiments.

In a first specific embodiment, the device for configuring surgical systems in accordance with the invention by means of a surgical system, consisting of a high-frequency device and different HF surgical instruments capable of being connected to and operated with this high-frequency surgery device is described. The high-frequency surgical device consists of a high-frequency generator for generating high-

frequency electric voltages, respectively currents, for monopolar, bipolar, or quasi-bipolar cutting and/or coagulating biological tissue as well as devices for adjusting, monitoring, controlling, limiting, and/or modulating the HF voltages, HF currents, electric light arches between active electrodes and biological tissue, and/or power required for cutting and/or coagulating. In addition, it is equipped with different modes of operation for coagulating and/or cutting, such as, for example, soft coagulation, forced coagulation, spray /3
coagulation, continuous cutting, or fractionated cutting, and automatic cutting control, as well as with devices for manual and/or automatic activation, and/or automatic deactivation, automatic limiting of the activation time, devices for automatic monitoring of different safety criteria, etc. The HF surgical instruments are, for example, monofunctional, bifunctional, or multifunctional instruments for monopolar, bipolar, or quasi-bipolar cutting, and/or coagulating biological tissue, each of these HF surgical instruments is equipped with a coding device, consisting of a definable impedance, for example a real resistance, a condenser, an inductance, or a resonance circuit consisting of a condenser and an inductance. A decoding device, which either is integrated in the high-frequency surgical device, or is a separate device, can be electrically connected with the coding devices of the different instruments. Advantageously this electric connection takes place by means of the connecting cable, which is used in a known way for connecting a surgical instrument to a high-frequency surgical device, this cable additionally being equipped with one or two

electric lines. The decoding device converts the respective impedance of the surgical instrument concerned into a specific electric signal, which is fed to a microprocessor. The microprocessor identifies this electric signal and automatically configures the high-frequency surgical device corresponding to a program stored in an electronic memory, which was created for the corresponding surgical instrument. If another HF surgical instrument is connected to a high-frequency device, the high-frequency device is automatically configured for this surgical instrument in this way.

The high-frequency device can be equipped with one or more connections for surgical instruments. If it is equipped with several connections for HF surgical instruments, the decoding device can be configured so that in the inactivated state of the high-frequency surgical device it automatically interrogates all connections sequentially and repeatedly, if and when what impedance is present on the respectively connection.

The embodiments described and further embodiments in accordance with the invention are shoe in Figs.1-6 of the appended drawing, respectively explained in greater detail therewith.

Fig. 5: Surgical system with several connections **21, 22, 23** for surgical instruments **1, 2**, N, that are equipped with coding devices C1, C2, CN and can be connected to a decoding device D via the relay contacts **11, 12, 13** of the relays R11, R12, R13. The decoding device D feeds electric signals to a microprocessor DPU. For example, this takes place in the following way. If one of the surgical instruments

1, **2**, **3**, for example instrument **1**, feeds an activating signal A1 of the possible activating signals A1, A2, AN supplies, or if another activating signal B, for example of a foot switch (not shown), or an automatic activating device (not shown), feeds to the CPU, the relay contact associated with the corresponding surgical instrument, for example the relay contact **11** closed by the relay R11 and by this the coding device C1 of the surgical instrument **1** concerned connected with the decoding device D. The decoding device interrogates the coding of this instrument and feeds a corresponding electric signal to the CPU. Thereupon the CPU configures all relevant devices (ESU, RU, SU, ... Y) corresponding to the nominal configuration previously determined and stored in the memory S, defined for this instrument. Thus, for example, the active electrode AE of instrument **1** is switched to the high-frequency surgical device ESU via relay contact r1 of relay R1 and all controlling and monitoring devices of the ESU correspondingly automatically adjusted, respectively configured. Thus, for example, the valve **30** of the washing device RU and/or the valve **33** of the suction device SU is automatically opened or closed. In addition, other devices Y can be automatically controlled, which feed signals to the respective instrument or receive signals therefrom, for example measuring signals of sensors of the corresponding instrument.

Patent Claims

1. A device for controlling and/or monitoring a high-frequency device having at least one high-frequency generator, which is suitable for monopolar, bipolar, and/or quasi-bipolar cutting and/or

coagulating, and to which different HF surgical instruments can be connected and operated, wherein the HF surgical instruments are equipped with an electric or electronic coding device, and for the high-frequency surgical device, to which one or more HF surgical instruments can be connected sequentially or simultaneously, at least one electric or electronic decoding device is provided, that can be connected with the coding device of the HF surgical instruments in each case connected to the high-frequency device, and which automatically converts the coding of the coding device of the HF surgical instruments in each case connected with them into electric signals, the control and/or monitoring devices of the high-frequency surgical device are supplied in order to configure the high-frequency surgical device to a mode of operation corresponding to the respective coding.

2. The device for controlling and/or monitoring surgical systems, consisting of at least one surgical instrument and at least one device, to which the surgical instruments can be connected and operated, wherein the surgical instruments are equipped with an electric or electronic coding device, and for the device to which one or more of these surgical instruments can be connected sequentially or simultaneously, at least one electric or electronic decoding device is provided, that can be connected with the coding device of the surgical instruments and which automatically converts the coding of the coding device of the surgical instrument in each case connected with it /4 each case to the device into electric signals, the controlling and/or

monitoring devices of the devices are supplied in order to configure the surgical system automatically to a mode of operation corresponding to the respective coding.

3. The device for the high-frequency surgery according to Claim 1, wherein the coding device of the instruments is an electric impedance.

4. The device according to Claim 3, wherein the impedance is an electric inductance.

5. The device in accordance with Claim 3, wherein the impedance is a real electric resistor.

6. The device in accordance with Claim 1, wherein the coding device is an electric resonance circuit.

7. The device in accordance with Claim 1, wherein the coding device is a codable plug system.

8. The device in accordance with one of the preceding Claims, wherein the configuration associated with a specific code is freely programmable, and the program associated in each case with a code can be stored in a memory.

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6 pages of drawings appended

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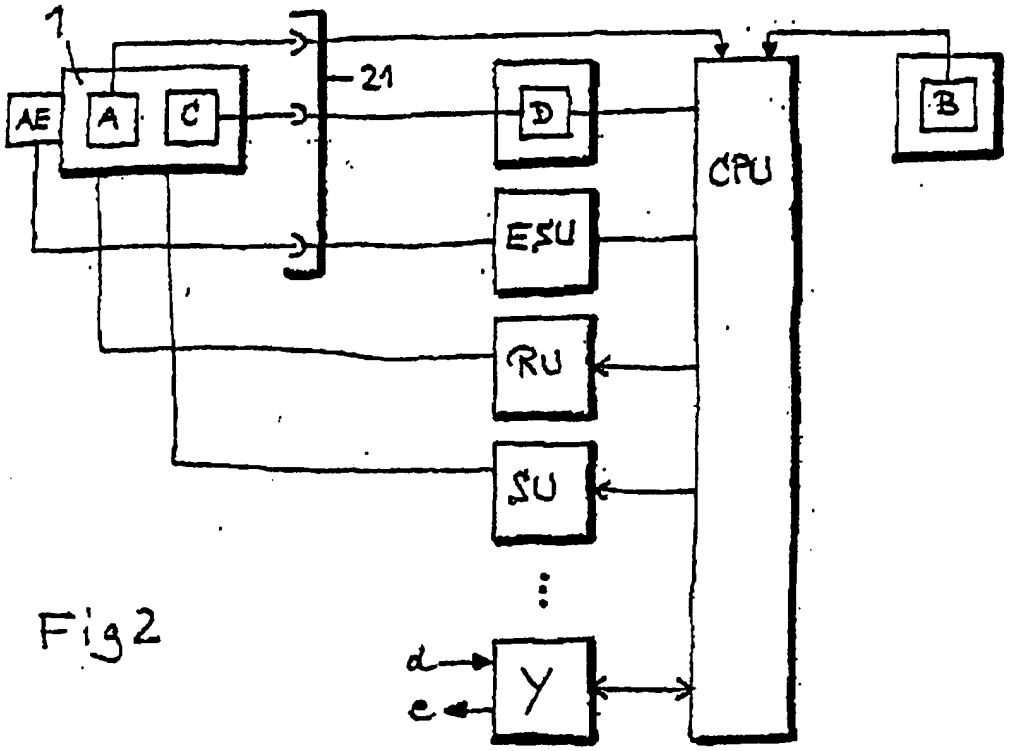

Fig2

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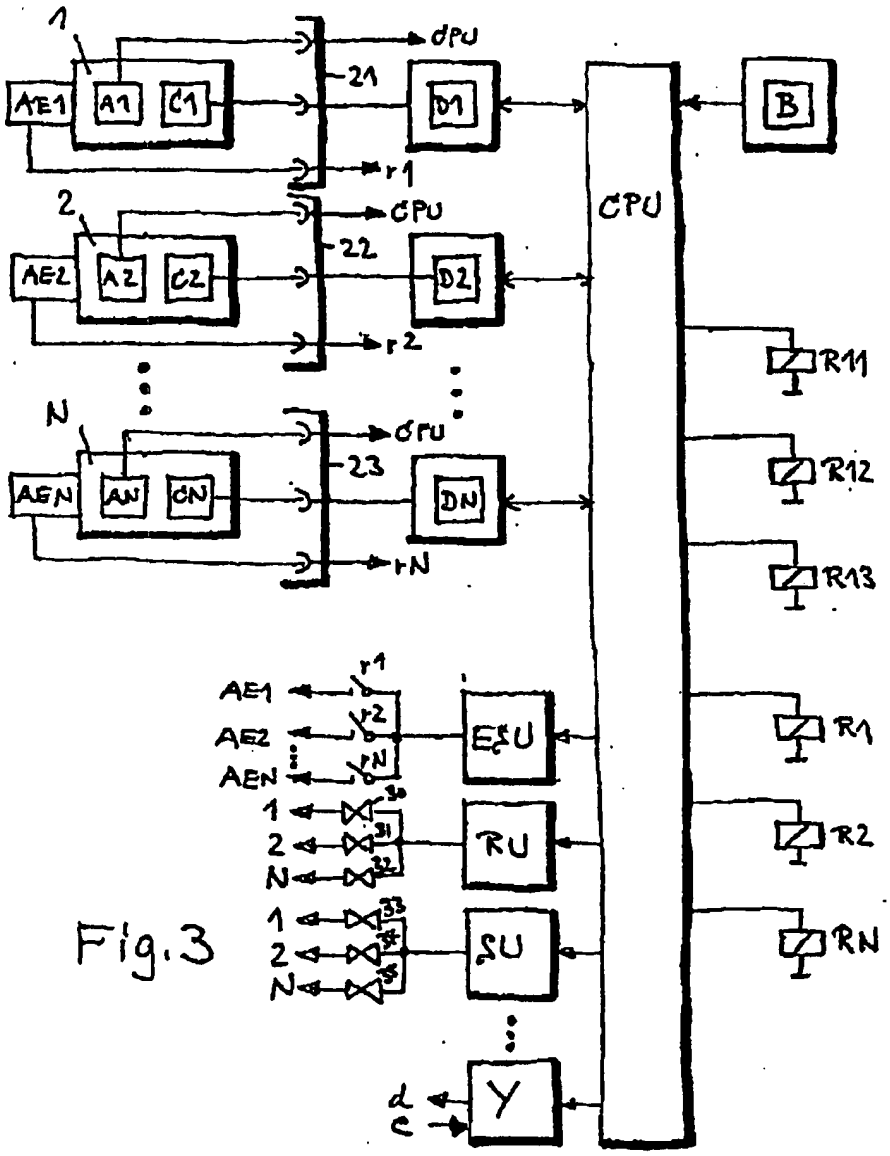

Fig.3

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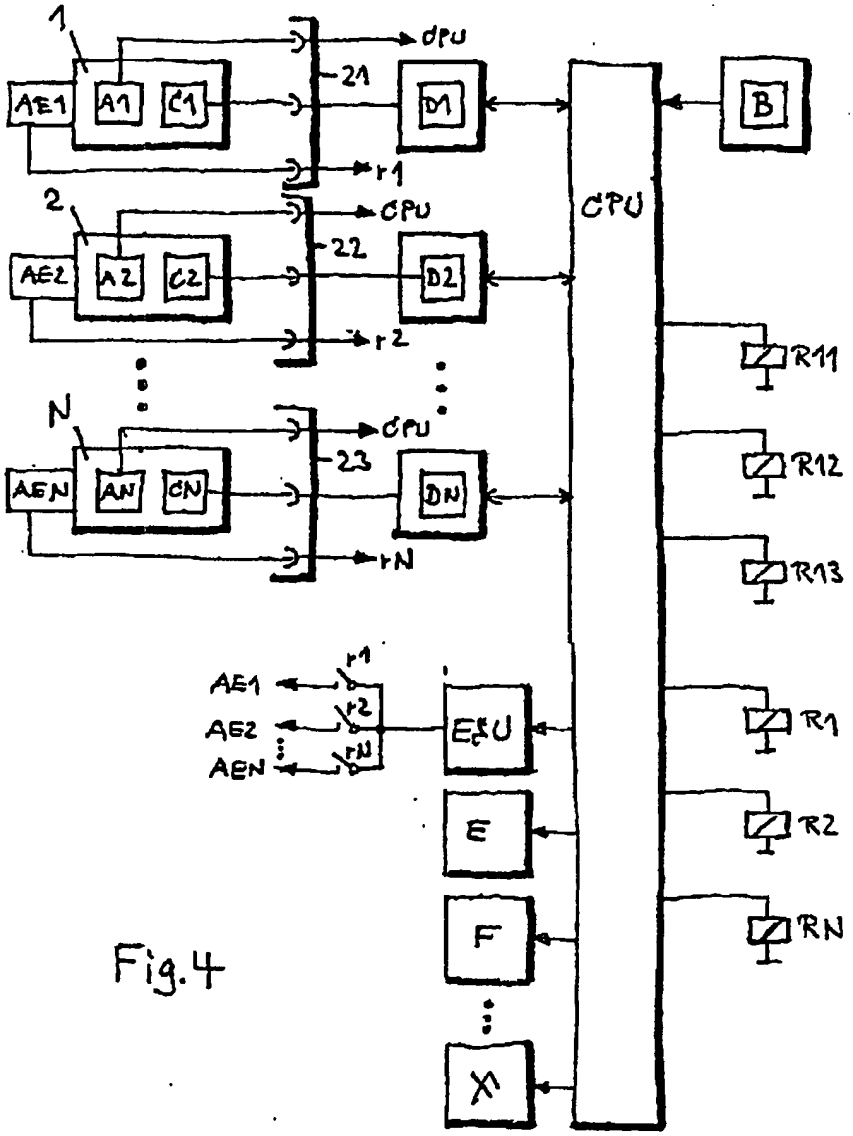

Fig.4

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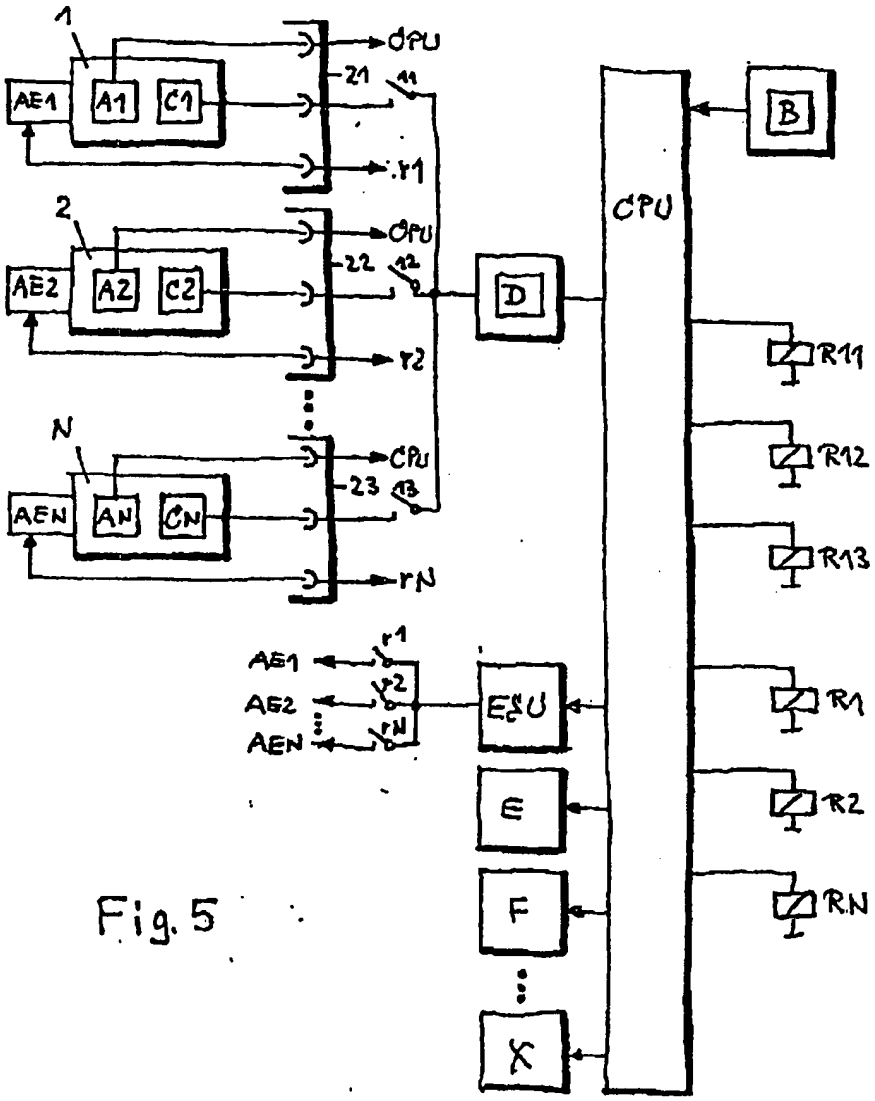

Fig. 5

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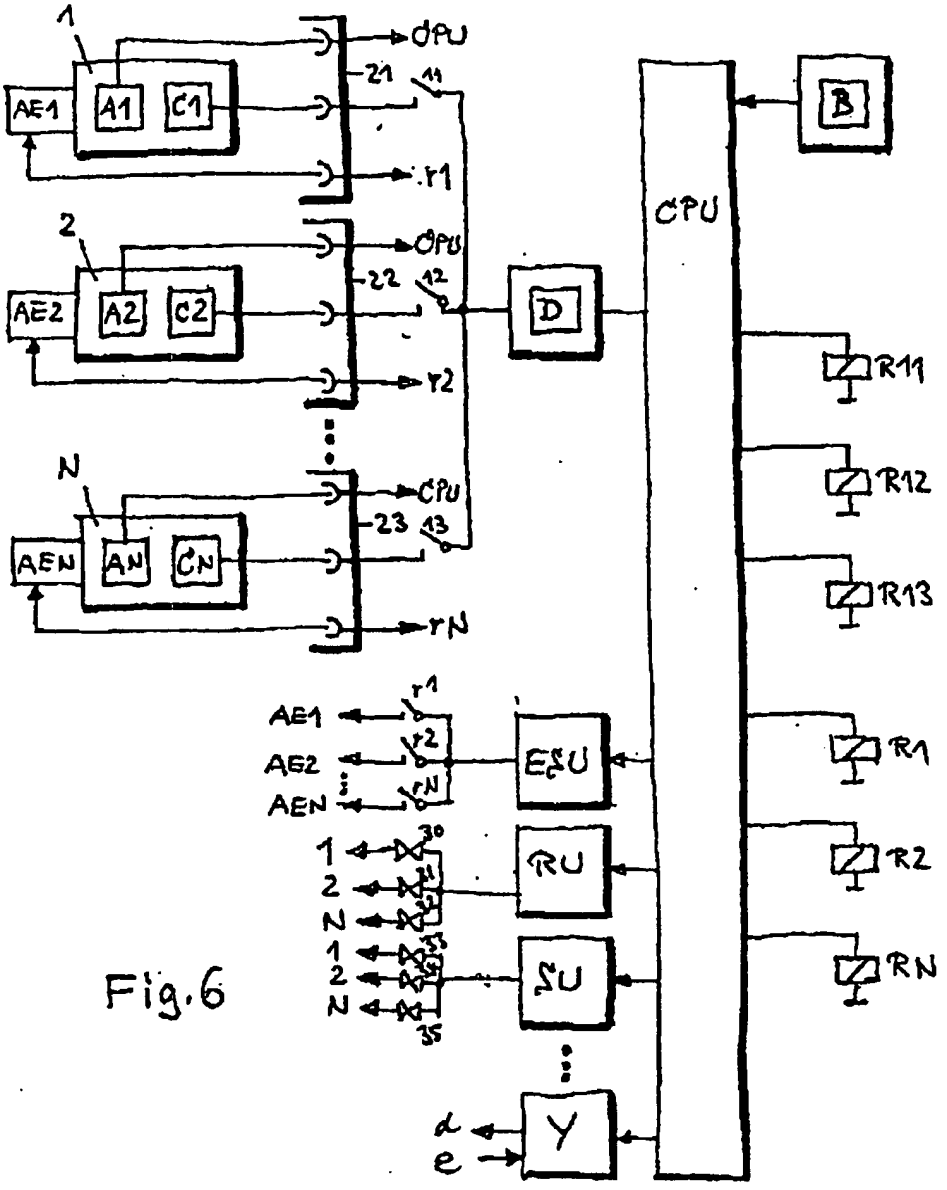

Fig.6